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ABSTRACT

One of a series of information packets, the document provides clear, specific information about the controversial subject of astrology. The packet includes six articles explaining the dozens of careful scientific tests which have concluded that there is no scientific evidence supporting astrology. The packet includes an interview with astronomer George Abell, who has spent considerable time examining and exposing the tenets of astrology. In addition, an annotated bibliography lists 19 books and articles published between 1974 and 1982 for further reading. (LH)

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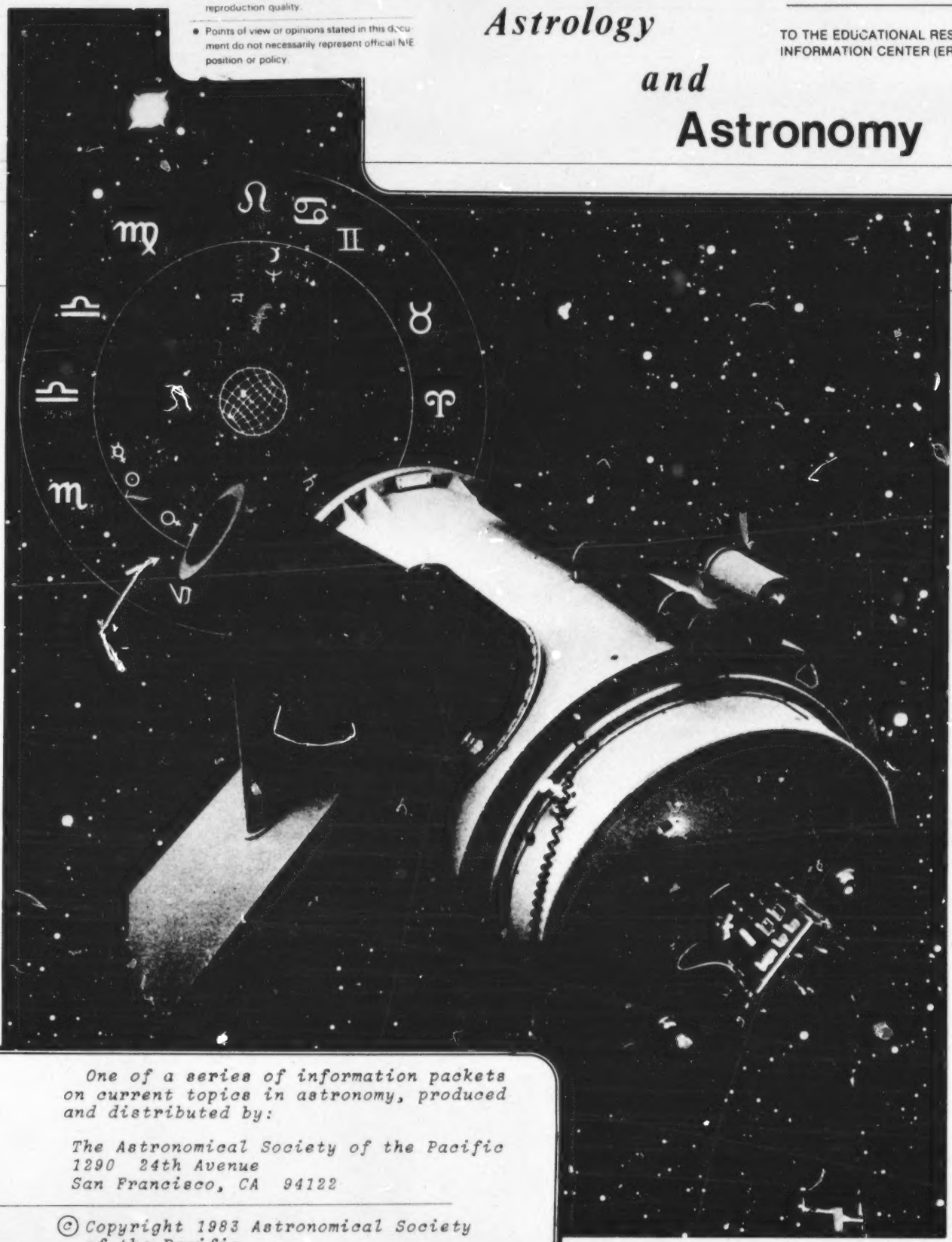
Astrology and Astronomy



One of a series of information packets on current topics in astronomy, produced and distributed by:

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The Zodiac Isn't What It Used to Be

By Andrew Fraknoi

EVERYONE is familiar with the two basic motions of the earth: its rotation on its axis and its revolution around the sun. While it *appears* to us that the objects in the sky are moving, daily and yearly, we know, of course, that this is merely an illusion caused by the motion of the planet on which we live.

For example, as the earth moves around it, the sun appears to shift its position relative to the background stars. The star groupings through which the sun appears to move are called the constellations of the zodiac and have names familiar to all readers of newspaper astrology columns.

In addition to rotation and revolution, the earth also experiences a motion called *precession*. The earth's rapid rotation (about 1000 miles per hour at the equator) tends to flatten the planet at the poles and to make it bulge at the equator. The uneven pulls of the sun and the moon on the near and far sides of the bulge force the earth's axis of rotation itself into a slow spin, very much like the motion of a top.

That is to say, the axis around which we spin also turns in a very gradual circle, coming fully around every 26,000 years. As a result of this slow wobbling of the earth, the apparent position of the sun against the zodiac constellations varies in a slow circle as well.

If it takes 26,000 years to go completely around the precession circle and there are 12 constellations of the zodiac, a little division will show that the sun's position in a given month will shift by one constellation every 2000 years or so.

★ ★ ★

Interestingly enough, historians of astrology tell us that it was about 2000 years ago that the system of modern signs and associated personality characteristics was set up. According to that system, one major factor in an individual's destiny is what constellation the sun was in at the time of his birth. Thus, someone who is a Scorpio (and has characteristics associated with water signs) is that way because when he was born the sun supposedly was in front of a grouping of stars which looked to the ancients like a scorpion.

But let us be careful! Because of precession, the sun's yearly path among the constellations of the zodiac has shifted by one constellation since astrology was set up. As a result, someone who was born November 1 and is called a Scorpio was actually born with the sun in the constellation of Libra!

This is just one of many reasons why recently 186 of the country's leading scientists issued a strongly worded statement warning the public that there is absolutely no scientific evidence supporting astrology.

Unlike our ancestors of 2000 years ago, we today understand the forces which the distant planets and stars (which we no longer take to be gods) exert on the earth and its inhabitants; their effects turn out to be inconsequentially small.

Although it might be tempting to believe that cosmic forces beyond our control determine our lives, as Shakespeare put it centuries ago. "The fault, dear Brutus, is not in our stars but in ourselves . . ."

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EXPLORING THE UNIVERSE

Astrology tests show no trends

By ANDREW FRAKNOI
Astronomical Society of the Pacific

For many years astrologers have claimed to be too busy practicing their art to submit to any scientific tests of their predictions.

However, their unwillingness has not deterred several groups of scientists from making a series of pioneering tests of the most popular form of astrology. Their conclusions should be of great interest to astrology buffs everywhere:

James Barth and James Bennett, two economists at George Washington University, examined the horoscopes of men who re-enlisted in the Marine Corps between 1962 and 1970. I think we would all agree that it takes a certain kind of personality to not only enlist, but re-enlist in the Marines. Barth and Bennett checked to see if there was a trend favoring astrological signs ruled by Mars (the god of war) among the re-enlistees (as opposed to signs ruled by Venus, for example). No such trend was observed.

Bernie Silverman, a psychologist at Michigan State University, asked astrologers to predict which astrological signs would be compatible and incompatible according to their horoscopes. He then obtained the records for 2,978 couples who got married and 478 couples who got divorced in Michigan in 1967 and 1968. When he looked at their birthdays and signs, he found no correlation with the predictions of the astrologers. Compatible signs got married — and divorced — just as often as incompatible ones.

But then who can understand the way of love?

In another experiment John McGervey, a physicist at Case Western Reserve University, looked up the birthdays of the 16,634 scientists listed in "American Men of Science" and of the 6,475 politicians listed in "Who's Who in American Politics." Certainly you might expect that scientists and politicians (two decidedly non-average groups) would tend to cluster more among certain signs of the zodiac — and certain personality types — than others. Yet McGervey found no such tendency.

Why then, do so many people think that astrology works?

If you look carefully at the astrological predictions in the typical newspaper or magazine, you can see that the statements are so general and vague that they can probably apply to any of us.

The results of one final experiment will show you why these statements work. Psychologist C. R. Snyder and his associates at the University of Kansas put together a fake personality description which included those phrases which they found most people apply to themselves. They showed this description to three groups of people, each of whom was asked to rate, on a scale from 1 to 5, how well it applied to them.

The first group, who were told it was general sketch, true for all people, rated it an average of 3.2. The second group, who were asked for the month in which they were born, and told the statement was a horoscope, rated it a 3.76. The third group, who were asked for the day on which they were born, and told that it was their personal horoscope, rated the same exact description a 4.38!

Apparently, those who want to believe, will.

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EXPLORING THE UNIVERSE

Scientific tests debunk astrology

By ANDREW FRAKNOI
Astronomical Society of the Pacific

A few years ago, in this column, we reported on some pioneering tests of the predictive powers of astrology. Since that time several other tests have been carried out to see whether the stars and planets are influencing out lives. Writing in the current issue of Mercury, the journal of the Astronomical Society of the Pacific, psychologist Ivan Kelly describes their results, which may come as a shock to the millions of astrology buffs in this country.

Astronomer Roger Culver of Colorado State University, for example, ran a test to see whether the sign of the zodiac under which a person is born might influence some physical characteristic in later life. He made 22 specific measurements on the bodies of 300 volunteers, including the following: biceps size, baldness, blood type, bust size, freckles, handedness, weight, neck size, and reach.

Having obtained the sun sign of each volunteer, Culver then looked for a relationship between signs and such characteristics. Were Leos more likely to go bald, for example, or Gemini to wind up ambidextrous? Culver found no trends whatsoever.

Similarly, three scientists, writing in the journal Psychology, have described a test they performed to see if the astrological signs might help us to identify leadership potential. They first identified what astrologers predict about leadership among the personalities associated with each Zodiacal sign. (It turns out, for example, that Virgo is supposed to be a weak leadership sign.) The scientists then checked the birthdays of 1,500 people randomly chosen from leadership biographies (Who's Who, etc.). Again, there were no trends; that is, there were just as many Virgo leaders as those with any other sign.

While these simple tests (and dozens of others like them) fail to show that astrology can predict either physical or psychological traits, some observers have suggested that there might be a hereditary effect in astrology, where parents can pass on their astrological characteristics to their children. This might connect astrology with biology or genetics in some way and put it on a scientific footing.

So the French statistician Michel Gauquelin examined horoscopes of 3,923 parent-child pairs to check the idea. (This study looked not only at the sun signs, which are familiar to daily newspaper readers, but at a whole host of astrological factors recommended by astrologers themselves.) Gauquelin's results, however, were completely negative: Astrological factors are not hereditary.

After examining many other such tests, Kelly concluded that there is now sufficient statistical evidence to rule out astrology as a working hypothesis.

And what about the claims by famous astrologers and their fans that they have made countless numbers of correct predictions over the years?

Astronomer Roger Culver and Philip Ianna have gone back and examined 3,011 specific predictions by well-known astrologers and astrological organizations, Kelly reports. Their results: Only 10 percent of these predictions ever came to pass.

If the stars lead us to incorrect predictions 90 percent of the time, they hardly seem the right guides to help us through the uncertainties of life. Which is just as it should be. For we now know that the stars are not mystic lights or the playthings of the gods, but nothing more and nothing less than other suns, unimaginably large and hot, incredibly remote, and mercifully unconcerned with the daily lives of the creatures who inhabit planet earth.

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A useful annotated bibliography of reliable references concerning UFOs, astrology, ancient astronauts and other areas of pseudo-science is available from the Astronomical Society of the Pacific. To get a copy, send 50 cents to cover postage and handling to: Pseudo-science, A.S.P., 1290 24th Ave., San Francisco, CA. 94122.

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The Scientific Case Against Astrology

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Astrology is one of most popular of all the fringe areas of science at the present time and appears to be still gaining in popularity. Since many members of the general public consider astrology to be a science — indeed a part of astronomy — there is good reason for everyone in the astronomical community to become familiar with the scientific evidence which has accumulated in regard to astrology.

Traditional Astrology

Proponents of astrology have benefited from an equivocation on the word "astrology". The term is most often used to signify a purported science that describes relationships between specific celestial configurations and human affairs. Predominant in these configurations are: the part of the ecliptic[1] through which the Sun is passing when a person is born (called the Sun, or zodiacal, sign); the constellation that is rising in the east when one is born (the ascendant); and the twelfth of the sky in which the Sun and planets are in at the moment of one's birth (houses). In addition, the so-called *aspects*, or angular relationships between the planets are considered to be important. Sextiles (60° angles) and trines (120° angles) denote harmonious personality functioning whereas squares (90° arc) and oppositions (180° arcs) represent inharmonious personality functioning. Defined in such a way, astrology is testable and refutable. The term, however, is used in a far wider sense by astrologers, a sense in which it is defined as "... the study of the correlations that can be established between celestial affairs and human affairs." (D. Rudhyar in *The Astrological Houses* (1972, Doubleday)). So defined, astrology becomes irrefutable and the ultimate pseudoscience. As such, as J. Agassi has pointed out, its underlying assumptions are elusive and not clearly articulated, and it better qualifies as a superstition.

The most extensive critical survey of empirical studies of astrology conducted by both astrologers and orthodox scientists and of other studies examining celestial-terrestrial relationships is Dean and Mather's recent compendium *Recent Advances in Natal Astrology: A Critical Review 1900-1976* (1977, Para Research.) A large portion of the book is given to descriptions of systems of astrology and the status of the current scientific evidence relevant to these systems. Dean and Mather's findings can be outlined as follows:

Present-day astrology is based on unsupported assumptions and opinions rather than on evidence. "Astrology today is based on concepts of unknown origin but effectively deified as 'tradition'. Their application involves numerous systems, most of them disagreeing on fundamental issues, and all of them supported by anecdotal evidence of the most unreliable kind. In effect, astrology presents a dazzling and technically-sound superstructure supported by unproven beliefs; it starts with fantasy and then proceeds entirely logically. Speculation is rife, as are a profusion of new factors (each more dramatically 'valid' than the last) to be conveniently considered where they reinforce the case and ignored otherwise."

Astrology has an almost unlimited retrospective capacity to describe anything over a wide variety of applications. Dean and Mather point out that it has yet to be demonstrated that delineations using the right birthchart are significantly better than those produced from the wrong chart. By giving a sufficient variety of descriptions that fit any person or situation and selecting interpretations that best fit the case, a horoscope constructed after-the-fact can be stretched to fit any situation. An illuminating example is provided by the astronomers Roger Culver and Philip Ianna in their book *The Gemini Syndrome* (1979, Pachart). They refer to the case of an astrologer who associated the presence of comets with significant terrestrial events. This individual gave an impressive list of events that he claimed to have occurred in 1774 and that were related to the presence of de Cheseaux's Comet. Unfortunately, as Culver and Ianna point out, de Cheseaux's Comet appeared thirty years earlier! They "have no doubts, however, that [the astrologer] could quickly come up with an equally impressive list of 'historical effects' for 1744 which would once more be due to the alleged impact of de Cheseaux's Comet in that year as well." Dean and Mather provide similar examples of retrospectively derived "strong correlations" between the analyses of the horoscopes of famous people and their careers or personalities in which the astrologers were using delineations based on wrong birth data.

1. The ecliptic is the circle described by the Sun in our sky as we move around the Sun in the course of a year. — *Ed.*

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Statistical Tests

Experimental tests conducted to examine astrological tenets yield generally negative results. The Dean and Mather book is a review of studies (pro and con) that were conducted to test astrological principles. They argue that, in balance, the evidence is against the validity of the astrological notions of zodiacal signs, houses, and planetary rulerships.

Since the Dean and Mather book was published, other results that reinforce the generally negative conclusions they reached have been published in scholarly journals. For example, Snell, Dean, and Wakefield, writing in *Psychology* (Vol. 16, p. 47), drew two random samples of 1500 entries from various leadership biographies to test leadership traits as predicted by astrological theory. Astrologers agree that "Virgo" is a weak leadership sign. If they are correct, we should expect Virgo individuals to be represented in the biographies less often than predicted by chance. However, when the study was done, individuals born under the sign of Virgo were not significantly different from the rest of the population in terms of their representation in the leadership biographies. Similarly, J. Noblitt, in a 1978 PhD dissertation at North Texas State University, tested the astrological notion that the angular relationships (sextiles, trines, squares, and oppositions) between the celestial bodies at the time of a person's birth are predictive of that individual's personality traits. The astrological prediction that the admixture of harmonious and inharmonious aspects should correlate with certain scores on personality tests (which indicate how relaxed or tense an individual is) was not supported and Noblitt's test, therefore, provides fairly decisive evidence against astrology.

Roger Culver tested the hypothesis that some physical characteristics are correlated with the signs of the zodiac (as described in his book *Sunsign Sunset* (1983, Pachart)). He tested about 300 people for a possible relationship between zodiacal sign and the following: arm size, baldness, bicep size, blood type, bust size, calf size, chest size, finger size, fist size, foot size, freckles, hair color, hand size, handedness, height, hip size, leg length, neck size, reach, skin color, weight, and wrist size. No relationsip was found among these factors and zodiac sign was found.

Michel Gauquelin has examined three astrological hypotheses. He first tested the claim that individuals in various occupations tend to be associated with particular zodiacal signs, moon signs, planet signs, mid-heaven signs, and ascendant signs. This hypothesis was tested by examining the distribution of the signs at the birth of 15,560 successful professionals belonging to ten different occupations. He then tested the hypothesis that a zodiacal heredity effect exists, namely, that there is a tendancy for children to be born under the same astrological factors as their parents. A total of 7,964 individuals and 3,923 parent-child pairs were examined. Finally, he tested for the validity of each of three traditional groupings of the zodiacal signs: positive/negative, which associates positive signs with extraversion and negative signs with introversion; triplicities, which associate groups of three signs with the four elements; quadruplicities, which associate groups of four signs with psychological characteristics such as activity, stability and adaptability. None of the astrological hypotheses under examination was supported.[2]

G.A. Tyson, in a paper in *The Journal of Social Psychology* (Vol 110, p. 73), examined the relationship between date of birth and career, as defined by course of study, for 10,313 university graduates. The results indicated fairly conclusively that there was no relationship between birthdate and career, and it was concluded that neither astrological nor season-of-birth factors influence choice of career. [Additional studies that provide negative support for astrology can be found in the accompanying box and in I.W. Kelly's review article "Astrology and Science: A Critical Examination" in *Psychological Reports* Vol. 44, p. 1231 (1979). — *Ed.*]

Other Problems

Apart from the negative evidence regarding the most important astrological tenets, astrology seems to be defenceless in the face of an increasing number of serious unresolved problems that lie at its base. The first is the issue over the number of signs that should be considered to lie in the zodiac. Different systems of zodiacal division vary from the early Euphratean six-sign zodiac to the traditional twelve-sign system to the 28 signs in one of the Chinese schemes. There is no empirical rationale for any of these systems. A similar comment can be made for the astrological aspects.

A second problem is the conflict between astrology's view that celestial influences are very pervasive in human affairs and the views of many fertile, progressive theories in psychology such as social learning theory. For example, astrology underestimates the role of the physical and social environment and factors such as birth order, differential fertility, and family of origin as determinants of an individual's chance to establish social status and follow a career.

A third problem, which astronomers are fond of pointing out, involves the precession of the equinoxes and the inclination of the ecliptic, about which there is some dispute in astrological circles. Because of the slow change in the Earth's rotational axis over time, the signs of the zodiac and their namesake constellations no longer coincide as they did two thousand years ago.

As shown in the accompanying figure, the Earth's axis traces a slow circle in the sky, taking about 26,000 years to return to any given point. As a result, the orientation of the Earth relative to objects in the sky is slowly changing. In particular, the monthly position of the Sun against the zodiac constellations is varying with the centuries. Since about two thousand years (or almost one-twelfth of the precessional cycle) have elapsed since the most commonly used zodiac systems were set up, all the zodiac constellations have been shifted by one.

Two contending zodiacs have arisen as solutions to the problem, although both have serious shortcomings. The most popular zodiac, the Tropical Zodiac, is defined in terms of time of year: consequently, the actual positions of the Sun and constellations relative to each other are ignored.[3] This leads to the scientifically problematic notion of an "imprinted space". That is, the zodiac signs are now no longer related to the actual

2. See M. and F. Gauquelin: *Statistical Tests of Zodiacal Influences: Book 1: Professions and Heredity* (1978, Laboratoire d'Etude des Relations entre Rhythmes Cosmiques et Psychophysiologiques, Paris).

3. The horoscopes one reads in daily newspapers are mostly Tropical. Since the signs are now shifted over by about one constellation, someone whose *sign* is Taurus (April 21 to May 21) actually had the Sun in the *constellation* of Aries when he was born. — *Ed.*

constellations after which they were named thousands of years ago. Instead, the space which has been assigned to the zodiac signs must somehow possess a set of influences of its own.

On the other hand, a minority of astrologers adopt a Sidereal Zodiac and cast a horoscope on the basis of the constellations which are actually near the Sun when one is born. This zodiac has a problem with correlating constellation and sign boundaries. For example, according to the limits agreed to by the International Astronomical Union, there are not 12 but 14 ecliptic constellations. Cetus and Ophiuchus both border on or

Some Tests of Astrology

by Jay Pasachoff

Moreover, astrology just doesn't work. Bernie I. Silverman, a psychologist at Michigan State University, tested specific values: Do Libras and Aquarians rank "Equality" highly? Do Sagittarians especially value "Honesty"? Do Virgos, Geminis, and Capricorns treasure the value "Intellectual"? Several astrology books agreed that these and other similar examples are values typical of those signs. Although believers often criticize objections on the ground that these group horoscopes are not as valuable or accurate as individualized charts, surely some general assumptions and rules hold in common.

The subjects, 1600 psychology graduate students, did not know in advance just what was being tested. They gave their birthdates, and the questioners determined their astrological signs. The results: no special correlation was apparent for any of the signs with the values they were supposed to hold. This was confirmed by statistical tests. As many subjects, regardless of their astrological signs, when asked to what extent they shared the qualities of each given sign, ranked themselves above average as below.

Furthermore, Silverman tested whether individuals from particular pairs of signs were especially compatible or incompatible. To do this, he sampled marriage and divorce rates in Michigan in 1967 and 1968. He compared these rates with the predictions of two astrologers as to compatible or incompatible combinations. His sample was large — 2978 marriages and 478 divorces — so even slight effects should show up in his statistical treatment. But none did — those born under "compatible" signs neither married more frequently nor divorced less frequently than would be expected by chance, nor did those born under "incompatible" signs marry less frequently or divorce more frequently. Silverman concluded that "the position of the Sun in the zodiac at birth does not affect later personality."

Similar statistical studies of signs "ruled" by Mars, the planet named for the god of war, and military reenlistment rates were recently carried out by James T. Bennett and James R. Barth, economists at George Washington University. They also found no empirical support for astrology.

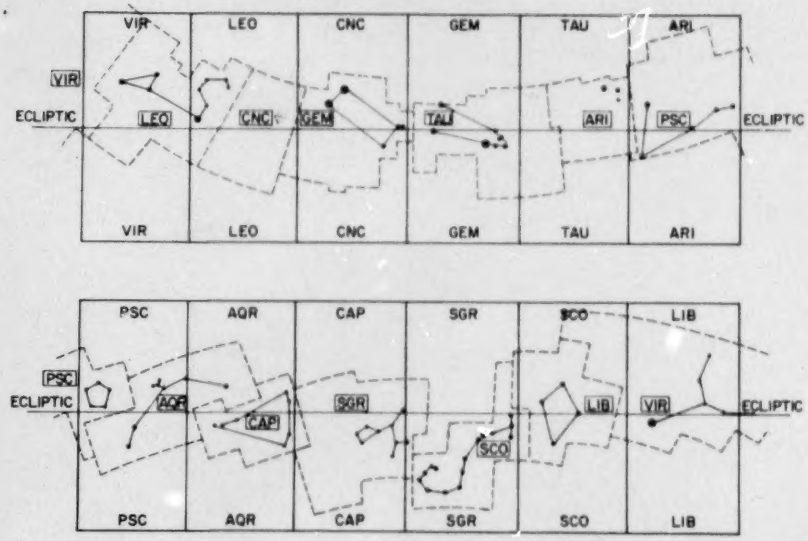
But if astrology is so meaningless, why does it still have so many adherents? Well, it could be the bandwagon effect, and Silverman had an ingenious test that endorsed this idea. He took twelve personality descriptions from astrology books, one for each astrological sign, and displayed them to two groups of individuals. The first group, composed of 51 subjects, was told to which astrological signs the descriptions pertained, and was asked to write their own signs on the covers of the questionnaires. More than half the members of this group thought that the descriptions listed under their own signs were, for each individual, among the four best descriptions of themselves out of the twelve choices. It would seem, if one considered only this phase of the experiment, that astrology was working.

Yet when the second group was given the twelve descriptions without mention of astrology, being told that they came from a book entitled "Twelve Ways of Life," their choices were random. Only 30 percent chose their own sign's description as being in the group most closely describing them. So the idea that astrology can predict personality types seems to be the result of self-delusion. When people know what they are expected to be like, they tend to identify themselves with the description. But that doesn't mean that they actually satisfy the description that astrology predicts for them better than any other description.

A historian of science has suggested that the bandwagon effect by itself is insufficient to explain belief in astrology, because astrological beliefs have persisted for so long. Astrology, following this line of reasoning, joins other pseudosciences in satisfying intuitional needs of individuals who do not clearly understand what science is, on what it is based, and what it has to offer us.

From the astronomer's point of view, astrology is meaningless, unnecessary, and impossible to explain if we accept the broad set of physical laws we have conceived over the years to explain what happens on the Earth and in the sky. Astrology snipes at the roots of all pure science. Moreover, astrology patently doesn't work. If people want to believe in it on an *a priori* basis, as a religion, or have a personal astrologer act as a psychologist, let them not try to cloak their beliefs in scientific astronomical gloss. The only reason people may believe that they have seen astrology work is that it is a self-fulfilling means of prophecy, conceived of long ago in times when we knew less about the exciting things that are going on in the Universe. Let's all learn from the stars, but let's learn the truth.

Editor's note: This material is reprinted with permission from Jay Pasachoff's popular textbook *Contemporary Astronomy*, 2nd ed., (© 1981 Saunders College/HRW). Dr. Pasachoff is director of the Hopkins Observatory at Williams College.



The Tropical Zodiac (solid rectangles) and the modern constellation boundaries (dashed lines). Because of the effects of precession, the tropical signs have slipped westward by nearly one complete sign relative to the sidereal signs. (From The Gemini Syndrome *by R. Culver and P. Ianna; ©1979, Pachart Publ. House; used with permission.)*

include the ecliptic.

In addition to the precession problem we have the problem that the most popular house systems used by astrologers do not work in certain circumstances. See the figure on the next page, for example.

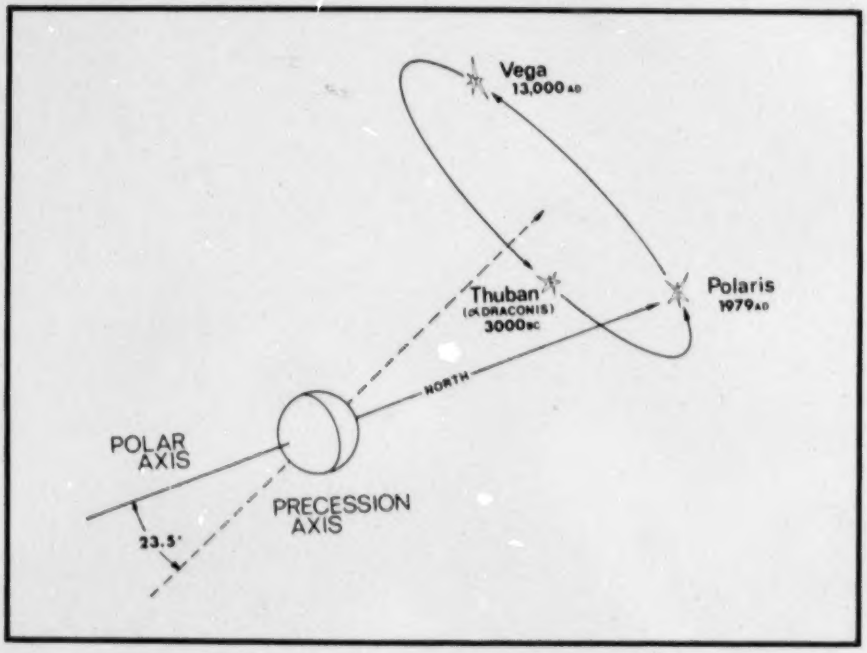
Another problem is the incompatibility of astrology with much present-day astronomical knowledge. The characteristics set forth by astrologers for their "astrological influences" are totally inconsistent with the forces discovered by the modern sciences.

There are two ways to rationalize astrology. One is to maintain that since the effect of the heavenly bodies cannot be due to gravitation or any other known force, it is necessary to postulate an unknown force. Now there is nothing especially wrong with this; it has been done before. But in this case, the *only* reason for the existence of this force is to explain astrology, which is a suspect proposition to begin with. Furthermore, such a force produces a circular argument: "We know the force exists because it explains astrology, and we know that astrology makes sense because of the force." If such a force were necessary to explain a lot of other things as well, the situation would be different, but it is not.

The other way to rationalize astrology, which has been used by some astrologers, is to claim that the planets do not actually *influence* human nature, but that there is a cycle of human nature that is matched by the cycles of the heavens. Now the mechanism of the heavenly cycles was explained by Newton, but no similar basis exists for the hypothetical cycle of human nature. And there is no explanation of how the human and heavenly cycles came to be synchronized with each other.

There are many other problems with astrology as it is presently practiced. For example, Anthony Standen, in his book *Forget Your Sunsign* (1977, Legacy) has pointed to the question of whether or not the constellations and houses should be given equal space since the constellations do not occupy equal areas on the celestial sphere. Nor is it clear how astrologers could have found out about the houses, planetary rulerships, and complex angular relationships and their purported association with human affairs in the first place. Then there is the time-twin problem — that is, the dissimilarity of individuals born at the same time. Many people also ask why astrologers assign significance to the time of birth rather than to the time of conception. If the planets affect me all my life, why did they not affect me before birth? If the force, whatever it is, can make itself felt over millions of miles of interplanetary space, are we to believe that it can be stopped by two inches of abdominal wall? (If it is, then can I escape the influence of the planets by simply wearing a slab of meat around my head?) As long as the astrologers continue to ask for the moment of birth instead of the moment of conception, they reveal that they have not thought through to the consequences of their position.

And even the moment of birth is



The precession of the Earth's axis in a slow circle changes the direction of our celestial pole. While Polaris is the North Star today, five thousand years ago, it was Thuban, and thousands of years from now it will be Vega. This same motion also displaces the point from which the signs of the zodiac were originally measured. (Illustration by Alan Alvaro.)

suspect. When does it occur? When the head appears, or the whole body? And how does one determine the moment of birth in a Caesarian section? What is the moment of birth of a frog who was incubated to term in a test tube? And furthermore, what happens if my mother falls down the stairs in the last week of pregnancy, and I am born several days earlier than I am supposed to be? How do the planets adapt for this? Or was my mother's fall pre-ordained or managed somehow, in order that I might be born at the right moment?

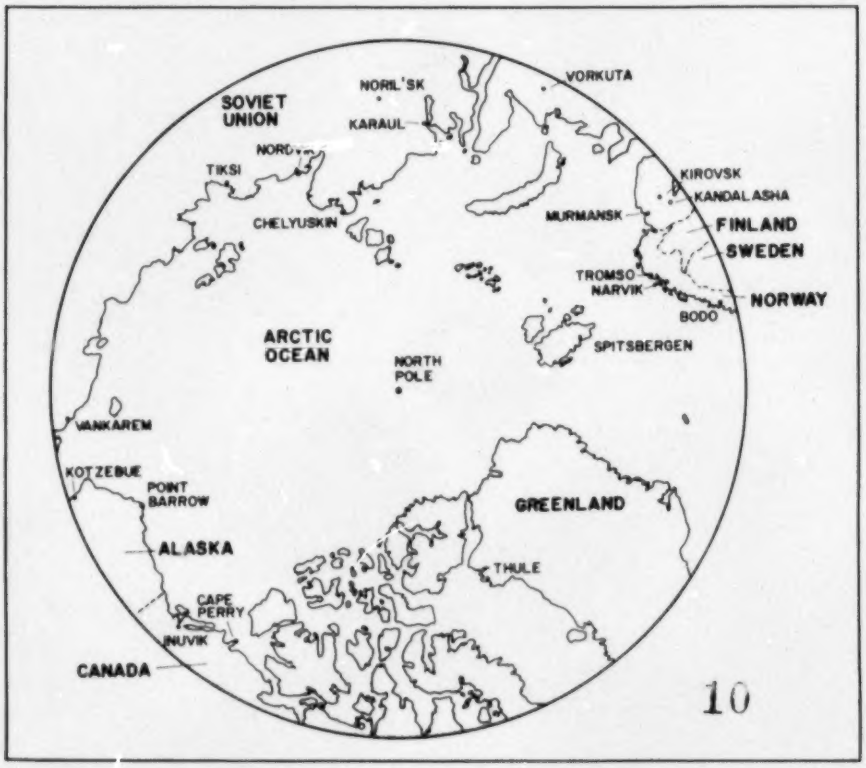
Then there is astrology's failure to predict future events or new experimental results. Culver and Ianna examined a total of 3,011 predictions by famous astrologers (e.g., Sydney Omarr, Carroll Righter, etc.) and astrological organizations. Barely 10% of these were fulfilled. Moreover, included in this ten percent were "marginally correct" predictions; that is, those that: (a) used vague wording ("There will be a tragedy in the eastern United States during the Spring months"); (b) had "inside" information regarding the person(s) involved ("Starlet A will be married to Director B before Christmas"); or (c) involved a prediction which could have been attributed to shrewd guesses ("The SALT talks will continue to be stalled for another year").

The sciences provide an internal check on each other. The findings in psychology, for example, are consistent with the findings in the other sciences. In the case of astrology, however, its claims run counter to what we know in physics, biology and psychology. Although all scientific theories have some problems, astrology is beset with so many anomalies that only by denying all the other sciences could it continue to stand.

Astrologers tend to respond in one of three ways to studies that demonstrate a lack of evidence for the validity of their discipline: first, they claim that, regardless what these scientific studies suggest, astrology "works" — it provides accurate and significant information about an individual's personality. Unfortunately for astrology, psychology can provide far better explanations of why astrologers are successful with clients. Dean and Mather refer to fourteen studies that have demonstrated that people readily accept general statements, such as those that are found in horoscopes, as applying accurately to their unique personality. David Marks and Richard Kammann, in their book *The Psychology of the Psychic* (1980, Prometheus), explain this phenomenon as follows: "Our personalities are not as fixed and constant as we usually imagine. Everybody is shy in one situation, bold in another, clever at one task, bumbling at another, generous one day, selfish the next, independent in one group of people, but conforming in another group. Thus, we can usually find aspects of ourselves that will match up with a vague statement, although the specific examples of self will be different from one person to the next.

"If you are told, 'You have a great need for other people to like and admire you', you can recall your own particular thoughts of wanting to make friends or be more popular. If you are told nearly the opposite, for example, 'You don't need other people to be your true self', you can recall personal times when you spoke your mind without regard for popular opinion, or alternatively, times when you just enjoyed being alone ... [In a horoscope] a person is told (ambiguously) what kind of a day to expect, what kind of person he is, or what the future will bring. But life itself is a fluctuating stream of diverse moments, and there is a good chance we can remember, or shall come upon, events that agree with the diagnosis. And, ... we end up saying, but it was so specific, it was right on the nose!" In addition, C. Snyder and R. Shenkel described in *Psychology Today* for March 1975 (p. 53) that they found that the more specific the birth infor-

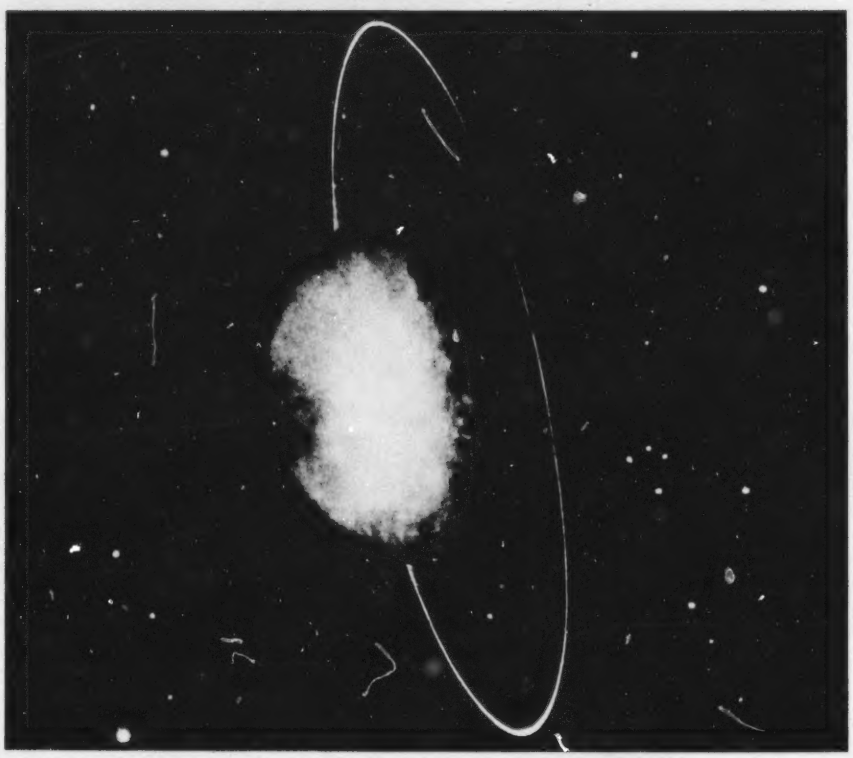
Dr. Bart Bok, now professor emeritus at the University of Arizona and a former president of the American Astronomical Society, has been one of the most outspoken and effective critics of astrology in the scientific community. In 1974 he helped organize a statement by 192 prominent scientists pointing out that there is no scientific basis for astrology.



The Astrological "No-Man's Land" around the Earth's north pole where the most commonly used astrological house division systems fail to generate a viable horoscope. (From The Gemini Syndrome *by R. Culver and P. Ianna; ©1979 Pachart Publ. House; used with permission.)*

mation required of a client by the astrologer, the greater the client's subsequent tendency to perceive a generalized horoscope reading as accurate. When these factors are combined with "cold reading" — that is, the astrologer picking up cues to an individual's character, education, and social class through observation of the client's appearance, speech, and mannerisms — and with coincidence, the "success" of astrologers can be explained by psychological factors.[4]

A second evasive tactic employed by astrologers is described by H. Eysenck in *Encounter* for Dec. 1979 (p. 87): "What they would say is that you cannot separate out from the large body of astrological knowledge certain aspects and hope to get very positive results. Personality, they would say, is determined by many things — aspects and positions of the planets, and of the moon, as well as of the sun, that any single element tends to be swamped by all the others." This tactic fares no better than the previous one. For one thing, even if the influence of any single element is very weak, it should be detectable using sensitive statistical methods and very large groups of subjects. Studies using large groups have been conducted, however, and have not shown positive results for astrology. Besides, surely some factors are more important than others, should have a stronger influence, and therefore should be easier to detect. In addition, this particular attempt by astrologers to get out of a bad position is counter-productive: the discovery of new planets in the last few centuries means that prior to their discovery astrologers were working on horoscopes that were grossly in error. Astrology, however, was extremely popular in the past and astrologers, ironically, cite this popularity as evidence for the validity of their system. As Culver and Ianna argue: "The question thus posed by the discoveries of Uranus, Neptune, and Pluto is why didn't astrologers, at some point in the dozens of centuries of astrological history, ascertain the presence of these three planetary influences? After all, these objectives do add up to a horoscopic presence of some *thirty percent* of the planetary influences, [and] ... the aspects of the other planets relative to Uranus, Neptune, and Pluto are almost universally deemed to have astrological importance for the horoscopes of *individual* human beings."



Artist's conception of the rings around Uranus discovered in March 1977. Astrologers have no explanation of how a planet like Uranus, an average of 2.9 billion kilometers from the Sun, can affect the fate or personality of a new-born baby. (Illustration by Rick Sternbach, courtesy N.A.S.A.)

The third and final dodge is to reject the empirical evidence as irrelevant and opt for a form of "Humanistic Astrology". Many astrologers, dismayed by the ever-growing body of evidence against their tenets, are retreating to obfuscation. As Mather pointed out in an article in *Zetetic Scholar:* "Some astrologers, fearing that science was catching up to them, have backtracked very rapidly, creating a smokescreen of symbolism, inner reality, holistic understanding, etc." Other astrologers are seizing on speculation about possible *non-causal* relationships between celestial events and terrestrial affairs. They argue that astrology is predicated on planetary and stellar *correlations*, not on their influence on human beings, and they postulate that the pattern of any instant of time is reflected in the angular relationships of heavenly bodies. One must view such speculation with great skepticism since its intent is solely to protect astrology from refutation. Such speculation has the great virtue of requiring no argument and the failing of saying nothing.

Dane Rudhyar, Humanistic Astrology's leading exponent, also writing in *Zetetic Scholar*, claims that astrology is a symbolic language which is "... a means to help human beings to give a fuller, richer meaning to their lives and to their relation to the universe in which they live. I see no value in the prediction of exact events or even of precise character analysis." In other words, astrology is of use only if it provides a system from which people can obtain personal value. Ironically, the mystical symbolism chosen by Rudhyar to convey meaning is so obscure one wonders how it could give personal value to anyone. Rudhyar contends that one's birthchart reveals, negatively, one's karma, and, positively, an individual's dharma. It does so, however, as an *archetype*, a complex chord of vibratory energy. In this sense it is considered the "message" that the universe (seen from a person's birthplace and birthmoment) imprinted on that person's genetic code. One can rightly ask why people would wish to use so confusing a code to express their values or give meaning to their lives. Surely it is odd to go to so much trouble to express values and meaning in such a form. Why not just talk about one's likes and dislikes? It is an arbitrary set of imagery — why not employ the symbolism of the 'Lord of the Rings' instead? It would at least have the advantage of being clearer. ■

4. For an excellent article on the subject, see R. Hyman's "Cold Reading: How to Convince Strangers That You Know All About Them" in *The Zetetic*, Vol. 1, No. 1, p. 18.

OBSERVING ASTRONOMERS:

GEORGE ABELL

ON

ASTROLOGY AND ASTRONOMY

Recent surveys have shown that over 30% of the North American public professes some belief in astrology and today there are many more practicing astrologers than astronomers. Astronomers, with a few notable exceptions, have refused to take these beliefs seriously enough to challenge them publicly. One person who has spoken out frequently against the unscientific claims of astrologers is George Abell, research astronomer, author of a popular undergraduate astronomy text, past president of the Astronomical Society of the Pacific and former chairman of the Astronomy Department at the University of California, Los Angeles. Dr. Abell recently met with Mercury editor, Richard Reis to discuss the nature of astrology, including some new statistical evidence.

REIS: Recently a somewhat controversial statement, "Objections to Astrology," written by astronomer Bart Bok, philosopher Paul Kurtz, and science writer Lawrence Jerome, was sent to many hundreds of scientists for their endorsement. Why did you endorse the statement?

ABELL: Because astrology is often presented in the name of science. I find that about one-third of our students at U.C.L.A. who are not majoring in science believe in astrology to some degree or another. I find that maybe 10 percent of the U.C.L.A. faculty, again non-science faculty, believe in astrology. There is a bill before the California legislature, Senate Bill 1280, which would license astrologers and accredit schools of astrology. We have the phenomenon of at least one U.S. senator in a job application form indicating "no water signs." Book stores and magazine racks are full of astrological literature. There are T-shirts, drinking glasses, ash trays, and souvenirs of all variety with zodiacal signs on them. It's a widespread phenomenon in our society today and most people are misled into thinking that astrology is a science. My main reason for endorsing the statement is to emphasize that astrology is *not* a science.

REIS: Nevertheless, there were a number of scientists who did not sign it.

ABELL: About a dozen of some 300 approached specifically declined to endorse the statement, but even they all agree with it and none of them believes in astrology. Their reasons for not signing were varied. Some have argued that astrology is a kind of religion and questioned whether we should try to discourage people's belief in a religion.

REIS: Some scientists have argued that any statement, by its very nature, will be dogmatic and unscientific.

ABELL: At least one or two scientists I talked to felt that if the statement were critical of astrology it should spell out why. But of course there wasn't space in the statement to explain in enormous detail why we are skeptical. Frankly, I consider these reservations to be nitpicking.

REIS: Do you believe that all astrologers are charlatans as the statement seems to imply?

ABELL: No. There are charlatans among professional astrologers, but also sincere believers. I regret that the statement could be interpreted as implying that all astrologers are charlatans. But you know that you can't get as diverse a group as a bunch of scientists to agree on the precise wording of any general statement on as complex a subject as astrology.

REIS: What about the idea that such a statement might be counterproductive, that it somehow dignifies astrology?

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ABELL: Scientists just don't regard astrology as a debatable subject — it's foolishness. It's incredible to most physical scientists that anybody could conceivably take it seriously.

REIS: How do you feel?

ABELL: I don't concur because I've talked to too many people who are not in the physical sciences not to know that many of them do indeed take it seriously. I think if many of my colleagues realized how deadly seriously many people take astrology, they would concur that it is not something we can just shrug off and say — well, that's something nobody believes in anymore.

REIS: What do you mean when you say astrology is not a science?

ABELL: Science is a procedure for exploring nature and for finding the laws by which nature behaves. Science must obey very specific rules in this investigation. It's very restrictive for that reason. There are many areas of human endeavor that science has nothing to do with — such as art, religion, music, literature, and so forth. But science has been enormously successful in the areas where it does apply, as everyone can tell from the products of science, our modern technology and the very exciting things we are discovering about the universe today. One of the characteristics of science is that it advances hypotheses that can be tested and disproved.

REIS: Then what does astrology do?

ABELL: Briefly, the idea is this: The sun, moon, and planets (all called planets in antiquity) move about in the sky through a belt called the *zodiac*. Now, the zodiac is divided into 12 equal parts called *signs*. In addition the entire sky is divided into 12 different sectors, fixed with respect to the horizon called *houses*. As the earth rotates, the zodiac with its signs and the planets all circle around and pass successively through the different houses.

Now a *horoscope* is a map or chart that shows what houses the signs are in and what signs and houses the various planets are in as seen at a specific time and from a specific place on earth. A *natal horoscope*, for example, is such a chart for the time and place of the birth of an individual. According to natal astrology (the kind most practiced today), the characteristics and entire life of that person are determined — or at least influenced — by the configurations of the signs and planets as depicted in his natal horoscope. Any astronomer could construct the horoscope itself, but its interpretation in terms of the astrological axioms that specify the alleged influences of the signs and planets and houses is the "art" of the astrologer.

George Abell has appeared on numerous radio and television programs to discuss the fundamental differences between astrology and astronomy. Photograph courtesy of CBS News.

REIS: And does astrology test these axioms by the methods of science?

ABELL: In principle it could, but astrologers don't play the game that way. First we have to ask, where does astrology come from? It is not, despite claims of many astrologers, a wisdom many thousands of years old. The origin of astrology, as it's practiced today, goes back at the earliest to Babylonia — not quite 1000 B.C. The zodiac itself wasn't invented until a few centuries B.C. The first natal horoscope was constructed in the first century B.C. The Greeks really developed the astrology we know, borrowing ideas from the Babylonians and the Egyptians. The Greeks combined their astronomy, which involved the motions of planets, with their polytheistic religion. The gods of their religion were immortal, but otherwise very human, and the Greeks ascribed the properties of these gods to the planets that were named for them. Astrology is therefore a sort of magical correspondence between the properties of the gods themselves and the planets that bear their names. The relationships between the gods and beasts of mythology are much the same as the supposed relationships between the planets and the zodiacal signs (actually the constellations for which the signs are named), and certainly have nothing to do with science.

REIS: Many astrologers would argue that it's not really fair to compare the astrology of Ptolemy's time with the astrology of today in the same sense that it would be unfair to compare Ptolemy's astronomy with today's astronomy.

ABELL: But astronomy has evolved enormously in 2000 years. In Ptolemy's time (the second century A.D.) the earth was still the center of the universe, and it wasn't even

realized that planets were made of ordinary atoms and ordinary matter, the same as people. On the other hand, astrology today is essentially the same as it was 2000 years ago. Astrologers still use the astrological axioms set out by Ptolemy in his *Tetrabiblos*—a sort of bible of astrology. All you have to do is compare it with the analysis of your own horoscope by a modern astrologer. Chances are that he never actually read the *Tetrabiblos* himself; still, you'll find exactly where those facts he told you about yourself ultimately came from.

REIS: Then you say astrology hasn't changed?

ABELL: I don't want to be misleading. Astrology has changed in some small ways, especially during the dark ages and the early Renaissance. There would be debates among astrologers on such details as the right way to define the houses, for example. There are also differences between the sidereal and tropical schools of astrology, but both still use Ptolemaic laws concerning the influences of the signs and the planets. The horoscopes may differ slightly in different systems, but the laws by which astrologers interpret the horoscope are still part of the same old Greek polytheistic religion.

REIS: And these aren't based on anything scientific?

ABELL: No. Nevertheless, astrologers have tried to rationalize astrology in terms of science. They are continually combing the scientific literature, or at least popular accounts, for all kinds of physical experiments, especially bizarre ones that seem to indicate some causal relationship between celestial objects and things on the earth.

When magnetism was discovered, it became a favorite thing. And of course, astrologers like to talk about tidal forces. We know the sun and moon make tides on the earth and we understand that very well as a gravitational phenomenon. Astrologers do not. They argue, "Look at the tremendous tides the moon produces on the ocean. Think what it can do to humans — humans are mostly water." It turns out, however, that a three pound book located six feet away exerts about 50 million times as strong a tidal force on a man as does Mars when that planet is at its closest to the earth. Tidal forces exerted by planets are completely negligible on something as small as a human being. Also consider electromagnetic radiation. The light and other radiation from all the planets combined is trivial by factors of millions compared to even small fluctuations in the sun's output.

REIS: What about the possibility of unknown forces, forces not yet discovered?

ABELL: Well, if there were any of the sort that could produce the alleged astrological influences, they would have to be very strange forces indeed. They would have to emanate from some but not all celestial bodies. They would have to affect some but not all things on the earth, and apparently only on the earth. They would have to depend in no way on the distances of the objects or their masses or other properties. In other words, these forces or laws would not have the unity, the beauty, the symmetry, the universality that we find in all other phenomena in the real universe.

REIS: But are they possible?

ABELL: I do not mean to imply that we know everything about the universe, that we know all the natural laws. Could there be unknown forces beyond the four we've discovered? I suspect there could be. Certainly there are unknown laws of nature. But the new laws we've discovered generally are consistent with the phenomena we understand. They expand the regime in which we can understand nature and they help us understand new regimes, new frontiers. Relativity didn't negate Newton's laws but it expanded the applicability of gravitational theory.

But even so, one should be open-minded and be willing to look at evidence presented for causal relationships between the planets and the earth, even though such are unexpected. Moreover, we should objectively consider evidence even of a statistical nature. Now I would guess that if astrologers themselves have any hope of finding scientific evidence for anything astrological, it would have to come through statistical investigations. Even most astrologers don't claim astrological laws are 100% binding. If they did, they'd be easy to shoot down because if there's one failure it's all over. If science has one failure in a hypothesis in a crucial experiment, then the hypothesis must be rejected.

REIS: Is there any statistical evidence for astrology?

ABELL: Let's consider some of the statistical studies that have been done — some by astrologers, some by others — that astrologers like to talk about. Certain ones keep recurring over and over again in the astrology books. One such example is the work of John Henry Nelson, who is an amateur astronomer and a retired engineer formerly with RCA. Nelson developed a system of trying to predict solar activity on the basis of certain angular configurations of planets as seen from the sun, and he claims to be using it with success. However, other people in the solar physics community have been unable to make it work.

REIS: What about the work of the psychologist, Carl Jung?

ABELL: Jung studied the sun-moon configurations in the natal horoscopes of 483 married couples. He hired statisticians to do a rigorous statistical study and the results came out negative, with no evidence at all that these aspects in astrology involve marital compatibility. Jung, however, wanting to believe in astrology, rejected his own statistical findings with the statement: "The statistical view of the world is a mere abstraction and therefore incomplete and even fallacious when it deals with man's psychology."*

REIS: Isn't there some interesting work now being done in France?

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* Jung, C. G. *Synchronicity: An Acausal Connecting Principle* (Chapter 2), in *Interpretation of Nature and the Psyche* (Princeton, 1955).

ABELL: One interesting thing that needs to be mentioned is the study over the past 20 years by Michel Gauquelin in Paris. He has collected the dates and times of births of more than 40,000 individuals from local registries in five European countries. The birth dates in the sample range from the late 18th century to the first half of the 20th century. Of these nearly 41,000 people, 16,000 are notables — meaning that they are (or were) all famous and successful in music, art, politics, science, athletics, medicine, acting, writing, journalism, or the military professions. Gauquelin's control group is a sample consisting of the remaining 25,000 ordinary people.

As you know, the planets move across the sky each day. Gauquelin divided the diurnal path of each planet into 36 sectors, which he later combined for his statistical studies into 18 or 12 sectors. He considered how long each planet spends in each sector, and asked, "What is the likelihood of a particular individual being born with a planet in each of these various sectors?" The answer depends not only on the astronomical data on where the planet is in the sky during various hours of the day, but also on demographic data, what times of the day people happen to be born. He calculated the theoretical expectation of a sample of people having each of the planets in each of the sky sectors for the moments of their births. For the actual sample of ordinary people he found that the distributions of the planets in the various sectors was just what one would expect from chance. But for the notables, in some cases at least, he found that certain planets tended to be in certain parts of the sky when individuals belonging to certain professions were born. For example, among 2088 sports champions he found a greater number being born with Mars having recently risen or recently culminated (crossing the meridian) than would be expected from random chance. Similarly, he found more military men were born with either Mars or Jupiter having just risen or culminated than chance would predict. For scientists the planet Saturn was involved in the rising or culminating sectors of the sky, and certain other planets figured in members of certain other professions. Some planets didn't figure at all — the sun, Mercury, Uranus, Neptune and Pluto; thus only the moon, Venus, Mars, Jupiter, and Saturn ever showed significant correlation between configuration and birth time.

REIS: Nevertheless, anything significant is interesting.

ABELL: Well, let's look at the sports champions, which is the particular study that's caused the most interest because it's also been checked by a committee in Belgium to study allegedly paranormal phenomena. That committee is known, for short, as *Comite Para.* Ten years ago the Committee studied an independent sample of 535 sports champions, and found that if they did the analysis following the same method as Gauquelin, they obtained the same general results. But they also found reasons to question the validity of Gauquelin's procedures, and as a consequence, to question the validity of his statistical results. They did not specifically show that the results were wrong, but they did show that certain of the assumptions on which they are based are not justified. One such assumption is that all possible configurations in the sky of the planet Mars over the years are equally probable. Another assumption, which I think is more crucial, is that the demographic distribution of births among various hours of the day is the same over the entire period of time and for all parts of Europe from which these sports champions' births were selected. The Comite Para suspects that Gauquelin's apparently interesting results may be a consequence of these invalid assumptions, and not of any true correlation between planetary configurations and birth times of athletes.

To check this suspicion, we are currently putting on punch cards the actual data for the athletes and have borrowed a tape from the U.S. Naval Observatory giving the ephemerides of the planets. We are going to check to see if there is any correlation at all between the distribution of birth times and the differences in right ascension between the sun and Mars. If Gauquelin's result is correct, there has to be such a correlation.

REIS: Who is "we?"

ABELL: I, and one or two people helping me — at the moment without pay. My guess is that we won't find a correlation, but if we do, we've got to try to find out why. What if under rigorous examination it should turn out that there really *is* such a correlation? It would be very exciting, but would be so unexpected that we would have to repeat the experiment again and again to be sure we had a thoroughly repeatable result.

REIS: Are you saying, though, that as a scientist you would welcome such a result?

ABELL: Well, I have to admit that it would probably shake me up a bit, but it's essential not to let my preconceived prejudices influence my judgment. Scientists are skeptical and conservative in the sense that they require very good evidence before accepting radically new ideas. But only by carefully checking out such possibilities, when they seem to be supported by valid evidence, can we expect to uncover interesting new phenomena.

REIS: But a little while ago you said that most astronomers can't fathom the idea that someone would take astrologers seriously enough even to talk to them.

ABELL: Even if we take Gauquelin's evidence on athletes at face value, we should emphasize that out of over 2000 athletes the excess number that were born with Mars in their rising or culminating sectors is only a few dozen. That's highly significant with a sample of this size, but still it's only a small fraction of all the sports champions. The vast majority became champions without the advantage of having Mars in those sectors. Moreover, think of the millions of people who are born with Mars in those sectors who never become athletes at all!

Finally, even in the event that Gauquelin's results should turn out to be precisely correct, they have nothing to do with classical astrology. In fact, Gauquelin, who is *not* an astrologer, insists that he has actually disproved astrology. The zodiac, for example, doesn't figure at all in the results he has obtained. He does think he's found something independent of astrology that is new. But even if so, it's certainly not something Ptolemy knew about. When a modern astrologer reads your horoscope, he doesn't do it by Gauquelin's rules, but by Ptolemy's.

REIS: I would like to turn to the television debates in which you appear. Do you feel they are of any

value?

ABELL: These aren't really debates. They're entertainment shows for the most part. The reason why I'm willing to be on such shows, not only about astrology but other subjects as well, is merely to get a forum and present the point of view that what astrologers and other occultists claim is not in the mainstream of modern science. Astrologers get forums all the time on radio and television talk shows and in newspapers, books, and magazines.

REIS: Over the years you've gotten to know some astrologers fairly well and you've met many others. What kind of people are they?

ABELL: They are all entirely different from each other. I'm convinced that some are quite bright people who don't believe in astrology any more than I do, but it's a good fast buck for them. I won't name names.

REIS: How many would fall into this category?

ABELL: I would guess that many of the highly successful ones would. I am quite sure that some of the very well-known astrologers are not sincere.

REIS: Is this view based on conversations you've had with them?

ABELL: Yes, and credibility. Take one, for example, that I know quite well. It's hard to say what his real beliefs are. I could imagine that he might think there could be something to astrology, but what he says depends on his audience. When he talks to me, he's quite scientific in his approach, and speaks of circadian rhythms and the sky as a great timekeeping device. I have seen him on TV shows, however, in which he would analyze people and tell them all about themselves, and then let it slip that he hadn't recalled their sun signs! I have even heard him indulge in palm reading. I think a person who can be fairly rational to me on one occasion, can't be that irrational to the public on other occasions, and be 100 percent sincere.

On the other hand, I've met some astrologers who I think are really true believers. Almost none of the astrologers I've met have had any hard scientific training. They've come from a variety of backgrounds, including the arts, psychology, and in one case, journalism.

REIS: How do your scientific colleagues react to your spending time with astrology and astrologers?

ABELL: I don't spend much time on it to be honest.

REIS: You have attained a fair bit of notoriety with it.

ABELL: In the past few months I've been on a number of radio and television programs, but they involve a tiny amount of my time. I would be reluctant to spend more than a small percentage of my time on astrology. Yet, I think it's important for scientists to spend some of their time on those bizarre things that are of very high interest to the public. I'm speaking of such fads as UFO's, astrology, the Bermuda Triangle, ancient astronauts, and the absurd theories of Velikovsky. It is not that we believe that there is anything to these things, but that a large fraction of the public does. Proponents of these bizarre ideas claim that they are true science and new discoveries, and often they receive wide publicity in the media. Yet, when scientists are consulted about them, most often they either refuse to comment or pooh-pooh the ideas without bothering to explain why they are nonsense. Now we astronomers, in particular, are almost all paid by public funds through universities or the federal government. I certainly agree that there are more important things to do than spending our time debating or investigating the occult. On the other hand, we have a situation today where a third of the people believe in astrology, and maybe two-thirds or more at least are open-minded about the possibility. So the overwhelming majority of the people paying our salaries are of the opinion that astrology may be a science (it is usually presented in the name of science), even though it's rejected by scientists. I think it is the duty of scientists not only to sell our science to the public and to explain and interpret it for the layperson, but also to explain why these occult things are not taken seriously by scientists and, indeed, what some of their dangers might be.

REIS: Would you be content if astronomers could make it clear to the public that astrology is not a science? Do you think that's where their responsibility ends?

ABELL: That's the most important thing to me. To make it clear that if people want to believe in astrology they should do so knowing that scientists, whom they are paying to investigate the universe, have been through all of these ideas before—mostly hundreds of years ago — and have long since satisfied themselves that the stuff is nonsense.

But every once in awhile something comes up like the results of Gauquelin. He's a man of some credentials, and there are many people who know about his work. I think it's irresponsible for us to write his stuff off without at least taking time to show why it can't be right. If we leave Gauquelin to the astrologers, then we have the peculiar situation of refusing to look at the only significant study claiming to suggest some validity to something that might be related to astrology. I strongly suspect that either Gauquelin is wrong or that there is a rational explanation for his results outside the realm of the occult. But I do believe the astronomical community has some obligation for public education, and such education includes an objective analysis of fads and myths in the name of science — but from an informed and responsible position.

REIS: I hope you have success in enlightening people about the differences between astronomy and astrology. But experience has shown that it is not an easy task. Why do you think you may have a chance to make some inroads against the widespread obsession with the occult arts?

ABELL: Because my natal chart has the sun and three other planets in Pisces, with Scorpio rising, and Saturn in the first house, squared with Neptune in the tenth. ■

A BIBLIOGRAPHY FOR ASTROLOGY

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